

## **Vitamin D: a Health/Disease Switch in MS.**

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### **Literature**

1. Round JL, Mazmanian SK. Inducible Foxp3<sup>+</sup> regulatory T-cell development by a commensal bacterium of the intestinal microbiota. *Proc Natl Acad Sci U S A*. 2010 Jul 6;107(27):12204-9.

### **Microbiota**

2. Ochoa-Repáraz J, Mielcarz DW, Wang Y, Begum-Haque S, Dasgupta S, Kasper DL, Kasper LH. A polysaccharide from the human commensal bacteroides fragilis protects against CNS demyelinating disease. *Mucosal Immunol* 2010, Sep;3(5):487-95.
3. Gaboriau-Routhiau V, Rakotobe S, Lécuyer E, Mulder I, Lan A, Bridonneau C, Rochet V, Pisi A, De Paepe M, Brandi G, Eberl G, Snel J, Kelly D, Cerf-Bensussan N. The key role of segmented filamentous bacteria in the coordinated maturation of gut helper T cell responses. *Immunity*. 2009 Oct 16;31(4):677-89.
4. Lee YK, Menezes JS, Umesaki Y, Mazmanian SK. Microbes and Health Sackler Colloquium: Proinflammatory T-cell responses to gut microbiota promote experimental autoimmune encephalomyelitis. *Proc Natl Acad Sci U S A*. 2010 Jul 28.

### **Mucus**

5. Kim YS, Ho SB. Intestinal goblet cells and mucins in health and disease: recent insights and progress. *Curr Gastroenterol Rep*. 2010 Oct;12(5):319-30.
6. Johansson ME, Phillipson M, Petersson J, Velcich A, Holm L, Hansson GC. The inner of the two Muc2 mucin-dependent mucus layers in colon is devoid of bacteria. *Proc Natl Acad Sci U S A*. 2008 Sep 30;105(39):15064-9.
7. Johansson ME, Holmén Larsson JM, Hansson GC. Microbes and Health Sackler Colloquium: The two mucus layers of colon are organized by the MUC2 mucin, whereas the outer layer is a legislator of host-microbial interactions. *Proc Natl Acad Sci U S A*. 2010 Jun 25.

### **Cathelicidin**

8. Tai EK, Wong HP, Lam EK, Wu WK, Yu L, Koo MW, Cho CH. Cathelicidin stimulates colonic mucus synthesis by up-regulating MUC1 and MUC2 expression through a mitogen-activated protein kinase pathway. *J Cell Biochem*. 2008 May 1;104(1):251-8.

### **Vitamin D**

9. Liu PT, Stenger S, Li H, Wenzel L, Tan BH, Krutzik SR, Ochoa MT, Schaubert J, Wu K, Meinken C, Kamen DL, Wagner M, Bals R, Steinmeyer A, Zügel U, Gallo RL, Eisenberg D, Hewison M, Hollis BW, Adams JS, Bloom BR, Modlin RL. Toll-like receptor triggering of a vitamin D-mediated human antimicrobial response. *Science*. 2006 Mar 24;311(5768):1770-3.
10. Adams JS, Ren S, Liu PT, Chun RF, Lagishetty V, Gombart AF, Borregaard N, Modlin RL, Hewison M. Vitamin d-directed rheostatic regulation of monocyte antibacterial responses. *J Immunol*. 2009 Apr 1;182(7):4289-95.
11. Lagishetty V, Misharin AV, Liu NQ, Lisse TS, Chun RF, Ouyang Y, McLachlan SM, Adams JS, Hewison M. Vitamin D deficiency in mice impairs colonic antibacterial activity and predisposes to colitis. *Endocrinology*. 2010 Jun;151(6):2423-32.

## Results

12. Kragt J, van Amerongen B, Killestein J, Dijkstra C, Uitdehaag B, Polman Ch, Lips P. Higher levels of 25-hydroxyvitamin D are associated with a lower incidence of multiple sclerosis only in women. *Mult Scler*. 2009 Jan;15(1):9-15.

## Discussion

13. Hayes CE, Donald Acheson E. A unifying multiple sclerosis etiology linking virus infection, sunlight, and vitamin D, through viral interleukin-10. *Med Hypotheses*. 2008;71(1):85-90.
14. Sun J. Vitamin D and mucosal immune function. *Curr Opin Gastroenterol*. 2010 Nov;26(6):591-5.
15. 14th Vitamin D Workshop consensus on vitamin D nutritional guidelines. Henry HL, Bouillon R, Norman AW, Gallagher JC, Lips P, Heaney RP, Vieth R, Pettifor JM, Dawson-Hughes B, Lamberg-Allardt CJ, Ebeling PR. *J Steroid Biochem Mol Biol*. 2010 Jul;121(1-2):4-6.
16. Hayes CE. Vitamin D news for multiple sclerosis patients. <http://www.nationalmssociety.org/chapters/ILD/download.aspx?id=26556> 2010 Oct 15
17. Van Amerongen BM, Dijkstra CD, Lips P, Polman CH. Multiple sclerosis and vitamin D: an update. *Eur J Clin Nutr*. 2004 Aug;58(8):1095-109. Review.
18. Turnbaugh PJ, Ridaura VK, Faith JJ, Rey FE, Knight R, Gordon JI. The effect of diet on the human gut microbiome: a metagenomic analysis in humanized gnotobiotic mice. *Sci Transl Med*. 2009 Nov 11;1(6):6ra14.
19. Kuipers, R. S., Luxwolda, M. F., Janneke Dijk-Brouwer, D. A., Eaton, S. B., Crawford, M. A., Cordain, L., & Muskiet, F. A. (2010). Estimated macronutrient and fatty acid intakes from an east african paleolithic diet. *Br J Nutr*. 2010 Sep 23:1-22.
20. Ramsaransing GS, Mellema SA, De Keyser J. Dietary patterns in clinical subtypes of multiple sclerosis: an exploratory study. *Nutr J*. 2009 Aug 10;8:36.